

UNITED STATES DEPARTMENT OF AGRICULTURE  
NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

WASTE TREATMENT LAGOON

(No.)  
Code 359

**DEFINITION**

A waste impoundment made by constructing an embankment and/or excavating a pit.

**PURPOSE**

To biologically treat organic waste, such as manure and wastewater, and to reduce its pollution potential as a treatment function component of an agricultural waste management system.

**CONDITION WHERE PRACTICE APPLIES**

This practice applies where: (1) an overall waste management system has been planned; (2) waste generated by agricultural production or processing needs treatment; (3) soils, geology, and topography are suitable for construction of the lagoon; (4) the lagoon can be constructed, operated, and maintained without polluting air or water resources; and (5) the lagoon embankment will have an effective height of 35 feet or less.

**CRITERIA**

**General Criteria**

**Federal, state, and local laws.** All planned work shall comply with all federal, state, and local laws and regulations. The Alabama Department of Environmental Management (ADEM) Rules require owners/operators of animal feeding operations (AFOs) and associated waste management systems to fully implement and regularly maintain effective best management practices (BMPs) that meet or exceed NRCS technical standards and guidelines to prevent discharges and to ensure groundwater and surface water quality. AFO owners/operators who fail to implement BMPs or

whose facilities discharge or will discharge to "waters of the state" can be required by ADEM or the Environmental Protection Agency to implement effective corrective actions immediately. If preventive or effective actions are not fully implemented in a timely manner, civil penalties may be incurred by the owners/operators.

**Location.** Lagoons shall be located where prevailing winds and landscape elements such as building arrangement, landforms, and vegetation minimize odors and protect the visual resource. The lagoon shall not be located within a 100-year floodplain unless it is protected from inundation or damage that may occur during that flood event.

Waste treatment lagoons shall meet the minimum requirement from public or private facilities as defined in the ADEM Administrative Code, Chapter 335-6-17, as amended.

**Hazard classification.** The area downstream of the embankment shall be evaluated to determine the impact of damage from a sudden breach of the proposed embankment on both structural and environmental features. This evaluation must consider all improvements and those improvements that may reasonably be expected to be made during the useful life of the structure. The results of this evaluation provide for the proper hazard approval classification of the embankment. Only hazard Class "a" embankments are to be designed under this standard. See National Engineering Manual (NEM) Part 520.23 for guidance in documenting hazard classification.

**Soils and foundation.** The lagoon lining shall have a permeability of  $1 \times 10^{-7}$  cm/sec or less, or a maximum allowable operational specific discharge of no more than 0.0028 ft/day.

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(NOTE: These rates may be reduced one order of magnitude due to manure sealing). The lagoon shall be located in soils that shall not exceed these rates or shall be sealed by mechanical treatment or by the use of an impermeable liner. Where possible, avoid sites with gravelly soils and shallow soils over fractured or cavernous rock. A detailed soils investigation with special attention to the water table depth and seepage potential must be considered in each design. Soil investigations must evaluate soils to a depth no less than 2 ft. below the final grade of any excavation. Subsurface investigation in soils underlain by the Demopolis or Mooreville Chalk formations of the Selma Chalk group in the Blackland Prairie major land resource area may terminate at a depth of 1 foot below the surface of the chalk.

**Liners.** Self-sealing ponds are not an acceptable means of containing waste. The subgrade shall be dense base regardless of liner method. Liners shall not be constructed to an elevation at or below the seasonal high water table unless methods to maintain the liner integrity are considered in the design. All liners shall be protected from damage during filling, agitating, and pumping operations. The lagoon shall be sealed by one of the liners as described below:

1. Compacted earth liner. An earth liner designed in accordance with Appendix 10D - Geotechnical, Design, and Construction Guidelines of the Agricultural Waste Management Field Handbook (AWMFH).

The soil shall be tested to determine the compaction and moisture requirements in order to not exceed the maximum allowable operational specific discharge.

Compacted earth liners shall have a minimum thickness of 1 foot on lagoon side slopes and bottom measured perpendicular to the finished surface. The final liner thickness shall be determined using procedures in Appendix 10D of AWMFH. The liner material shall be placed in layers not over 9 inches thick and compacted to the required density to ensure the liner does not exceed the maximum allowable operational specific discharge. Moisture content before compaction shall be approximately 2 percent wet of optimum. Compaction requirements shall be verified in accordance with ASTM D 698.

Compacted earth liners shall have side slopes of 3 horizontal to 1 vertical (3:1) or flatter, except where compacted earth liners are part of (brought up with) an earthfill operation. When the PI of the compacted earth liner exceeds 20, consideration should be given to covering the liner with not less than 1 foot of compacted on-site material measured perpendicular to the finished surface.

2. Flexible membrane. A flexible membrane liner designed and constructed in accordance with the NRCS conservation practice standard, Pond Sealing and Lining (Flexible Membrane), Code 521A.
3. Bentonite. A bentonite liner designed and constructed in accordance with the Appendix 10D of AWMFH and the NRCS conservation practice standard, Pond Sealing and Lining (Bentonite), Code 521C. The bentonite liner shall be covered with not less than 1 foot of compacted on-site material measured perpendicular to the finished surface to protect from drying cracks and weathering.
4. Soil Dispersant. A soil dispersant liner designed and constructed according to laboratory analysis and in accordance with Appendix 10D of the AWMFH and the NRCS conservation practice standard, Pond Sealing and Lining (Soil Dispersant), Code 521B.
5. Concrete. A concrete liner designed and constructed in accordance with NEH Construction Specification 32, Structure Concrete, and the following criteria:
  - a. For side slopes and bottoms that will not have any vehicular traffic, use a minimum 4-inch concrete slab placed over a minimum 6-inch layer of well-compacted, non-shrink-swell foundation material. No expansion or contraction joints are required. However, if construction joints are used, a flexible waterstop will be required in the joint. Wire mesh or fiber reinforcement is required.
  - b. For concrete lined areas such as approaches, ramps, and bottoms that will have vehicular traffic of any kind, use a minimum 4-inch concrete slab placed over a minimum 6-inch layer of

well-compacted granular material. Concrete joints and reinforcement shall be as required by design analysis.

- c. Concrete lined side slopes shall be 2 horizontal to 1 vertical (2:1) or flatter, except for concrete push-off ramps. Concrete push-off ramp slopes shall be 1 horizontal to 1 vertical (1:1) or flatter on cut slopes and 2 horizontal to 1 vertical (2:1) or flatter on embankment slopes.
6. **Natural clay base.** In situ soils classified in permeability groups III or IV as defined in Appendix 10D of the AWMFH are acceptable provided they have a minimum thickness of 2 feet below the deepest excavation limits and are at dry densities equivalent to at least 90 percent Standard Proctor (ASTM D 698). The required minimum thickness of the natural clay base shall be determined using procedures in Appendix 10D of AWMFH. Special precautions must be taken if the soils contain high amounts of calcium. Subsurface investigations must demonstrate that suitable natural soil material exists for the minimum depth required below the design bottom elevation of the lagoon and that no highly unfavorable geologic conditions occur at the site.

Natural clay based liners shall have side slopes of 2 horizontal to 1 vertical (2:1) or flatter.

**Required volume.** The required volume for lagoons shall include a volume or depth for the following:

1. Minimum treatment volume (anaerobic lagoons only).
2. Manure, wastewater, and other wastes accumulated during the hydraulic retention period.
3. Normal precipitation (on the area inside the dike top width) less evaporation (on the surface area of the lagoon surface at the required volume level) during the hydraulic retention period and any runoff from drainage areas that enter the lagoon during the hydraulic retention period.

4. Volume of accumulated sludge (2-year minimum) for the period between sludge removal events.
5. The 25-year, 24-hour storm precipitation (on the area inside the dike top width) during the treatment period and any runoff from drainage areas that enter the lagoon from the storm event.
6. When a primary and secondary cell are used, the volume of the primary cell shall be the sum of the minimum treatment volume plus a 2-year sludge accumulation volume, minimum.

**Treatment period.** The treatment period is the hydraulic detention time between supernatant drawdown events. It shall be determined so as to prevent discharge and surface or groundwater pollution and be the greater of either 60 days; the time required to store the supernatant for environmentally safe utilization considering the climate, crops, soil, and equipment requirements; or as required by local, state, and federal regulations.

**Waste loading.** Daily waste loading shall be based on the maximum daily loading considering all waste sources that will be treated by the lagoon. Design loading shall be based on the maximum average weight of animals using the lagoon and on other waste introduced. Reliable local data should be used if available. If local data is not available, Chapter 4 of the AWMFH should be used for estimating waste loading.

**Treatment design.** A lagoon's treatment function shall be designed on the basis of the 5-day biochemical oxygen demand (BOD<sub>5</sub>) or volatile solids (VS) loadings as appropriate.

**Embankment.** The minimum elevation of the top of the settled embankment shall be 1 foot above the maximum design water surface in the lagoon. This height shall be increased by the amount needed to ensure that the design top elevation will be maintained after settlement. This increase shall not be less than 5 percent. The combined side slopes of the settled embankment shall not be less than 5 horizontal to 1 vertical (5:1) and neither slope shall be steeper than 2 horizontal to 1 vertical (2:1) unless special provisions are made to provide stability. The top of the dike shall slope slightly toward the outside dike slope in order to direct as much rainfall as possible from the lagoon.

The minimum top width shall be as shown in Table 1.

<b>Table 1 - Embankment Top Width</b>	
<b>Total height of embankment ft</b>	<b>Top width, ft</b>
<15	8
15 to <20	10
20 to <25	12
25 to <35	14
35	15

As a minimum, compaction of the embankment fill material shall be equivalent to, or better than, the following:

1. Layers of fill shall not exceed 9 inches in thickness before compaction. Compaction shall be accomplished by routing the hauling and spreading equipment over the fill in such a manner that every point on the surface of each layer of fill will be traversed by not less than two tread tracks of the loaded equipment traveling in a direction parallel to the main axis of the fill.
2. If a minimum required density is specified, each layer of fill shall be compacted as necessary to obtain the density. Special equipment shall be used, if needed, to obtain the required moisture content and degree of compaction.

**Excavations.** Excavated side slopes shall be stable and not less than 2 horizontal to 1 vertical (2:1) unless provisions are made to provide stability. The bottom of aerobic lagoons shall be approximately level.

**Embankment spillway.** Embankment lagoons (those having a maximum design liquid level against the embankment of 3 feet or more above natural ground) shall be provided with an emergency spillway, overflow structure, or combination to protect the lagoon from overtopping when the lagoon is at the maximum operating level and a 25-year, 24-hour storm event is exceeded. The crest of the emergency spillway or overflow structure shall be located at

or above the top of the 25-year, 24-hour storm storage. The depth added to the lagoon to contain the 25-year, 24-hour storm volume shall be a minimum of 1 foot. The settled top of the embankment shall be a minimum of 1 foot above the designed liquid level in the lagoon with the emergency spillway or overflow structure operating at the design discharge.

The emergency spillway shall be placed in undisturbed soil when possible. When it must be placed in fill material, precautions shall be taken to insure the integrity of the structure. When locating the emergency spillway, areas near the lagoon corners and the side containing the inlet shall be avoided, if possible.

Embankment lagoons with a drainage area shall have an emergency spillway, overflow structure, or combination designed to pass a 25-year, 24-hour storm on the entire contributing drainage area while maintaining the required freeboard. Embankment lagoons without a drainage area shall have an emergency spillway, overflow structure, or combination designed to pass a 25-year, 24-hour storm on the area inside the dike top width while maintaining the required freeboard.

Lagoons that do not require an emergency spillway or overflow structure shall have a minimum freeboard of 1 foot above the top of the required volume.

**Inlet.** Inlet shall be of any permanent type designed to resist corrosion, plugging, and freeze damage.

Inlets may be push-off ramps, paved slopes, or pipe inlets. If freezing is not a problem, an open inlet, such as a concrete channel, may be used.

Paved slopes shall be no flatter than 4 horizontal to 1 vertical (4:1) and shall not be used when appreciable bedding materials are used. Pipe inlets may be steel, concrete, aluminum, or PVC meeting the requirements of NRCS conservation practice standard, Pond, Code 378. However, if corrugated steel is used, it shall be adequately protected with an appropriate coating.

Inlets from enclosed buildings shall be provided with a water-sealed trap, vent, or similar device if there is a potential, based on design configuration, for gases to enter buildings or other confined spaces.

Pipe inlets shall have a minimum diameter of 6 inches and shall be designed to carry the required flow without plugging. Pipes shall be installed on a slope of 1 percent or greater. Wye or tee fittings shall be placed at a maximum spacing of 150 feet to facilitate cleanout of the pipe in case of blockage. The inlet pipe should extend a sufficient distance from the shoreline to ensure good distribution. Pipes shall be installed far enough below the ground surface to avoid freezing or be provided with other protective measures.

Pumped inlets shall be sized to meet the requirements of the pumping equipment. Gravity flow inlet pipes for liquids shall discharge at or above the maximum design volume elevation. The slope of the lagoon and the liner at the pipe outlet shall be protected from erosion by paving, extending the pipe outlet to a point where the discharge will not fall directly on the slope resulting in damage to the slope or liner, or using a flexible down pipe at the pipe outlet during filling. Pipes installed above ground shall be supported on pilings of pressure treated wood, steel, concrete, or masonry and anchored to prevent dislodging or flotation. Pilings shall be installed so as to maintain liner integrity.

**Outlet.** No outlet shall automatically discharge supernatant from the required volume of the lagoon. Outlets from the waste treatment lagoon shall be designed to resist corrosion and plugging.

**Facility for drawdown.** A structure shall be provided for drawing down the supernatant level in the lagoon. It may be a dock, pumping platform retaining wall, or ramp. Ramps used to withdraw supernatant shall have a slope of 4 horizontal to 1 vertical (4:1) or flatter.

Where agitators are used in lagoons with liners, the tip of the propeller shall be a minimum of 3 feet from the liner surface or the liner shall be protected by a concrete pad.

**Sludge removal.** Provision shall be made for removal of accumulated sludge to preserve the treatment capacity of the lagoon. The anticipated method for accomplishing this must be considered in determining the size and shape of the lagoon and type of liner.

**Waste application.** All waste removed from the lagoon shall be utilized in accordance with NRCS conservation practice standard, Nutrient Management, Code 590.

**Protection.** To control erosion, embankments and disturbed areas surrounding the lagoon shall be vegetated according to NRCS conservation practice standard, Critical Area Planting, Code 342.

**Safety.** Designs shall include appropriate safety features to minimize the hazards of the lagoon. The lagoon shall be fenced and warning signs posted to prevent anyone from using it for anything other than its intended purpose. A "WARNING" sign (90 in<sup>2</sup> minimum) shall be placed on each straight section of fencing, not to exceed a spacing of 300 feet, to alert the public to the hazards of the lagoon. Fencing shall meet the requirements of NRCS conservation practice standard, Fence, Code 382, with safety as the objective.

### **Anaerobic Lagoon Criteria**

**Loading rate.** Anaerobic waste treatment lagoons shall be designed to have a minimum treatment volume based on VS loading per unit of volume. The maximum loading rate shall be as indicated in Figure 10-22 of the AWMFH or according to state regulatory requirements, whichever is more stringent. If a high degree of odor control is necessary, loading rates shall be decreased.

**Operating levels.** The maximum operating level shall be the lagoon level that provides the required volume less the 25-year, 24-hour storm event precipitation (on the area inside the dike top width) and any runoff from drainage areas that enter the lagoon from the storm event. The maximum operating level shall be marked with an appropriate staff gage set in the lagoon or by other means to indicate when drawdown is needed. The maximum drawdown shall be to the level of the combined accumulated sludge volume and minimum treatment volume. A permanent marker shall be installed at the elevation to indicate when drawdown is to cease.

The minimum operating level after drawdown should normally be the minimum treatment volume and sludge volume except when the lagoon is in drawdown to permit sludge removal or addition of dilution water.

**Depth requirements.** The minimum depth at maximum drawdown shall be 6 feet. If subsurface conditions prevent practicable construction to accommodate the minimum depth at maximum drawdown, a lesser depth

may be used if the volume requirements are met.

### **Naturally Aerobic Lagoon Criteria**

**Loading rate.** Naturally aerobic lagoons shall be designed to have a minimum treatment surface area determined on the basis of daily BOD<sub>5</sub> loading per unit of lagoon surface. The maximum loading rate shall be as indicated in Figure 10-25 of the AWMFH or according to state regulatory requirements, whichever is more stringent.

**Operating levels.** The maximum operating level shall be the lagoon level that provides the required volume less the 25-year, 24-hour storm event (on the area inside that provides the dike top width) and any runoff from drainage areas that enter the lagoon from the storm event. The maximum level shall be marked with an appropriate staff gage set in the lagoon or by other means to indicate when drawdown is needed. The maximum drawdown shall be the level of the combined volume of accumulated sludge and volume of manure, wastewater, and clean water accumulated during the treatment period. A permanent marker shall be installed at this elevation to indicate when drawdown is to cease.

**Depth requirements.** The depth at maximum operating level shall be 5 feet maximum. the depth at maximum drawdown shall not be less than 2 feet.

### **Mechanically Aerated Lagoon Criteria**

**Loading rate.** Mechanically aerated lagoons' treatment function shall be designed on the basis of daily BOD<sub>5</sub> loading and aeration equipment manufacturer's performance data for oxygen transfer and mixing. Aeration equipment shall provide a minimum of 1 pound of oxygen for each pound of daily BOD<sub>5</sub> loading.

**Operating levels.** The maximum operating level shall be the required lagoon volume less the 25-year, 24-hour storm event precipitation and any runoff from drainage areas that enter the lagoon from the storm event and shall not exceed the site and aeration equipment limitations. The maximum level shall be marked with an appropriate staff gage set in the lagoon or by other means to indicate when drawdown is needed.

**Depth requirements.** The depth at maximum operating level shall be 5 feet maximum. The depth at maximum drawdown shall not be less than 2 feet.

### **Lagoons Constructed in High Water Table Soils**

Lagoons constructed in high water table soils shall be based on a detailed risk assessment. The risk assessment shall include an analysis of the potential for ground water pollution considering the hydrogeology, ground water transmissivity, soil permeability, etc. Decisions to install lagoons in high water table soils without liners must provide reasonable assurances that it will not cause surface or ground water pollution.

If during the risk assessment, it is determined that the site is a potential hazard to ground water pollution, it shall be designed with a liner to prevent contamination of ground water. Methods to maintain the liner integrity shall be included in the design.

The 25-year, 24-hour storage volume for lagoons constructed in high water table soils shall be in the volume above the natural high water level elevation.

## **CONSIDERATIONS**

### **General Considerations**

Waste treatment lagoons are of three general types: (1) anaerobic, (2) naturally aerobic, and (3) mechanically aerated. Anaerobic lagoons require less surface area than naturally aerobic lagoons but may give off odors. Naturally aerobic lagoons are relatively odor free. Mechanically aerated lagoons are comparable in size to anaerobic lagoons and are generally odor free, but they require energy for aeration.

Lagoons should be located as close to the source of waste as possible.

To reduce sludge buildup, remove solids from the waste of animals, such as dairy cattle, that are fed high roughage rations. A solids trap or a separator may be provided between the waste sources and the lagoon. This may be a concrete or earth structure that can be emptied periodically. Settling facilities should have adequate capacity to store settled solids for a time period based on climate, equipment, clean out of frequency, and method of disposal. Solid

separators, debris basins, etc. shall be designed to prevent seepage to the groundwater.

In order to reduce the impact of objectionable odors on the public and the potential for pollution of the water resources, the lagoon location should meet the minimum distance requirements from public and private facilities as shown in Table 2.

<b>Table 2. Minimum Distance Requirements for Waste Treatment Lagoons</b>	
<b>Public or Private Use Facilities</b>	<b>Minimum Distance from Lagoon</b>
Any public use area, church, picnic area, playground, etc.	700 feet
Residence or place of habitation other than owner or tenant	700 feet
Well, down gradient from lagoon	300 feet
Well, up gradient from lagoon	150 feet
Natural Water Courses	200 feet
Milking Parlor	100 feet
Drainage Ditches	100 feet
Area specified by state or local ordinance.	Greater of state or local distance or distance shown above.

It is recommended that these distances be increased wherever possible in order to minimize any negative impacts of the lagoon. In no case shall the lagoon siting distances be less than the minimum distance requirements as required by the ADEM Administrative Code Chapter 335-6-17, as amended.

Vegetative screens or other methods should be used to shield the lagoon from public view and to improve visual conditions.

Non-polluted runoff should be excluded from the lagoon to the fullest extent possible.

Lagoons will have an affect on the water budget. The affect will be dependent upon the size of the lagoon. The lagoon will cause an increase in evaporation and a decrease in downstream runoff where drainage is routed to the facility. The lagoon is routed to the facility. The lagoon will not increase water damage at the site.

The lagoon should have an overall positive impact on water quality by treating animal waste and polluted runoff until it can be safely applied to the land. There can be a positive effect on water related wildlife habitat by providing open water bodies. Water quality can be adversely impacted during initial construction due to erosion of the site but will be minimal using proper construction pollution prevention measures.

Development of an emergency action plan should be considered for lagoons where there is a potential for significant impact from breach or accidental release. Where there is potential for significant impact, the plan shall include site specific emergency action plan provisions for minimizing the impact.

Due consideration should be given to economics, the overall waste management system, and safety and health factors.

**Considerations for minimizing the potential for sudden breach of embankment or accidental release from the required volume.**

Features, safeguards, and/or management measures to minimize the risk of embankment failure or accidental release or to minimize or mitigate impact of this type of failure should be considered when any of the categories listed in Table 3 may be affected.

<b>Table 3. Potential Impact Categories from Breach of Embankment or Accidental Release</b>
1. Surface water bodies - perennial streams, lakes, wetlands, and estuaries.
2. Critical habitat.
3. Farmstead, or other areas of habitation.
4. Off-farm property.

The following should be considered either individually or in combination to minimize the potential of or the consequences of sudden breach of embankments when one or more of the potential impact categories listed in Table 3 may be affected:

1. An auxillary (emergency) spillway.
2. Additional freeboard.
3. Wet year rather than normal year precipitation.
4. Reinforced embankment - such as, additional top width, flattened and/or armored downstream side slopes.
5. Secondary containment.

The following should be considered to minimize the potential for accidental release from the required volume through gravity outlets when one or more of the potential impact categories listed in Table 2 may be affected:

1. Outlet gate locks or locked gate housing.
2. Secondary containment.
3. Alarm system.
4. Another means of emptying the required volume.

**Considerations for minimizing the potential of waste treatment lagoon liner failure.**

Consideration should be given to providing an additional measure of safety from waste treatment lagoon leakage when any of the potential impact categories listed in Table 4 may be affected.

<b>Table 4. Potential Impact Categories for Liner Failure</b>
1. Any underlying aquifer is at a shallow depth and not confined.
2. The vadose zone is rock.
3. The aquifer is a domestic water supply or ecologically vital water supply.
4. The site is located in an area of carbonate rock (limestone or dolomite).

Should any of the potential impact categories listed in Table 4 be affected, consideration should be given to the following:

1. Soil blanket lining with additional thickness.
2. Flexible membrane liner over a soil blanket liner.
3. Concrete liner.

**Consideration for minimizing the impact of odors.**

For sites located in areas where odors could affect neighbors, the following should be considered:

1. Reducing anaerobic loading rates to at least one-half the values of AWMFH Figure 10-22.
2. Covering the storage facility with a suitable cover.
3. Using naturally aerated or mechanically aerated lagoons.
4. Using composting in conjunction with a solid waste system rather than a liquid or slurry system.
5. Using a methane digester and capture system.

**PLANS AND SPECIFICATIONS**

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirement for applying the practice to achieve its intended use.

Engineering plans, specifications, and reports shall include the following as a minimum:

1. Type and number of animals the structure is designed to serve.
2. Plan view of system layout.
3. Soil and foundation findings, interpretations, and reports.
4. Typical cross sections of lagoon.
5. Drainage/grading plan if one is needed.
6. Structural details of all components.

7. Quantities.
8. References of components supplied by others (pumps, etc.).
9. Special safety requirements.
10. Vegetative requirements.
11. Construction specifications.
12. Operation and maintenance plan.

## **OPERATION AND MAINTENANCE**

An operation and maintenance plan shall be developed that is consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for its design. The waste treatment lagoon should be inspected periodically to ensure that all components are operating as planned.

The O&M plan shall contain the operational requirements for supernatant drawdown. It shall include maximum operating levels and operation requirements of structural components, etc. The O&M plan shall include the requirement that waste shall be removed and utilized at locations, times, rates, and volume in accordance with NRCS conservation practice standards Manure Transfer, Code 634; or Nutrient Management, Code 590. Records shall be kept of the amount of waste applied, location and acres where applied, and the date waste was applied.

The lagoon shall be operated so as to be at the minimum operating level at the beginning of the

most critical treatment period (usually late fall), and to maintain the storage capacity for the 25 year, 24-year storm. Development of an emergency action plan should be considered for lagoons where there is a potential for significant impact from breach or accidental release. The plan shall include site specific emergency action provisions for minimizing the impact.

Prior to initial filling, the inside slopes of the dikes shall be vegetated, mulched, or mechanically protected to prevent erosion. The embankment and other vegetated areas shall be mowed and fertilized to maintain a protective vegetative cover.

## **REFERENCES**

- ASTM D 698
- National Engineering Hand Book Series, Part 651 - Agricultural Waste Management Field Handbook, Appendix 10 D.
- NEM, Part 520.23
- NRCS Conservation Practice Standards
  - Critical Area Planting - Code 342
  - Fence - Code 382
  - Manure Transfer - Code 634
  - Nutrient Management - Code 590
  - Pond - Code 378
  - Pond Sealing and Lining
    - Flexible Membrane - Code 521A
    - Soil Dispersant - Code 521B
    - Bentonite Sealant - Code 521C
- NEH, Part 642, Construction Specification, 32, Structure Concrete
- ADEM Administrative Code, Chapter 335-6-17, as amended.



# CONSTRUCTION SPECIFICATION FOR WASTE TREATMENT LAGOON

## CODE 359

### SCOPE

This specification shall consist of the clearing, grubbing, excavation, backfill, concrete, forms, reinforcing steel, other appurtenances, and services required for the construction of a waste treatment lagoon, incidental structures, and the disposal of all cleared and excavated materials. Construction shall be carried out in such a manner that erosion, water, air, and noise pollution will be minimized and held within legal limits as established by state and federal regulations.

All structures shall be constructed according to plans furnished by the Natural Resources Conservation Service (NRCS) and in accordance with the NRCS's engineering standards for these practices, as well as any local codes or state laws. Any deviation from the approved drawings and specifications must be approved by the engineer prior to construction.

### SPECIFICATIONS FOR WASTE TREATMENT LAGOONS

#### Clearing

All trees, brush, and stumps shall be removed from the site and spoil areas before excavation is performed. All material cleared from the area shall be disposed of by burning or removing from the site and stacking. All burning shall conform to regulations of Alabama state law.

#### Excavation

The completed excavation, berms, and placed banks (spoil disposal) of unsuitable material shall conform to lines, dimensions, grades, and slopes shown on the plans or staked on the site to the degree that skillful operation of the excavating equipment will permit. Runoff from outside drainage areas will be diverted from the waste treatment lagoon.

Borrow material shall be obtained from within the lagoon site as much as practical. The

bottom of the lagoon shall be uniformly flat as possible. Any changes in slope of the lagoon bottom will be approved by the engineer responsible for design. Any excess borrow material will be disposed of by: (1) raising the height of or widening the embankments or by flattening the slopes; (2) blending in with the diversion or levee; or (3) hauling off-site.

#### Dike or Levee Construction

The placing and spreading of fill material shall be started at the lowest point of the foundation and shall be brought up in approximately horizontal layers not exceeding 9 inches in thickness before compaction. These layers shall be of approximately uniform elevation and shall extend over the entire area of fill. Construction equipment will be operated over the area of each layer in a manner that will result in a specified degree of compaction and a watertight structure. Special construction equipment will be used when the required compaction cannot be obtained by routing of the construction equipment. Construction of the fill shall be undertaken only at such times that the moisture content of the fill material will permit satisfactory compaction. If the material is too dry, or too wet, the fill material shall be manipulated (adding water, drying, disking, etc.) to obtain the desirable moisture content.

#### Liner Construction

Detailed specifications for liner construction will be specified in the plan by the design engineer.

#### Inlet and Outlet Structures

Inlet and outlet pipes, flumes, and troughs shall be placed to the lines and grades shown on the plans.

#### Ramp Installation

When used, an inlet ramp shall be constructed to the dimensions, lines, and grades shown on the plans or as otherwise specified.

### **Materials**

All of the component parts of the inlet and outlet pipes and supports, ramps, fences, and other materials shall be specified on the plans and shall be installed in a workmanlike manner. Concrete for flumes or other concrete structures associated with the lagoon shall be as specified below.

### **Concrete**

This work shall consist of furnishing, forming, placing, finishing, and curing Portland cement concrete as required in the construction of the work. When concrete is used, the mixture shall be no less than a 5-bags-per-yard mix. Water content shall not exceed 6.0 gallons per sack. Concrete will be thoroughly rodded or vibrated to remove voids and consolidate the concrete.

Small batch mixture shall be as follows:

A standard brand Type 1 Portland cement, washed sand, and gravel. Clean water shall be used in the mix. (Suggested ratio of aggregates in mix: 94 lb. cement (1 bag), 6 gal. water, 170 lb. clean dry sand, 315 lb. dry gravel.

Smaller batches: 1 part cement, 2 parts sand, and 3 parts gravel, and water at the rate of 1 gal. per 16 lb. of cement.

Concrete shall not be placed when the atmospheric temperature may be expected to

fall below 40°F at the time concrete is delivered and placed at the work site.

All exposed surface of the concrete shall be protected from the direct rays of the sun for at least the first 7 days. All concrete shall be cured by keeping it continuously moist for at least 7 days after placement. This moist curing can be accomplished by spraying with two coats of curing compound when other concrete will not be bonded to the treated surface.

### **Vegetation**

Vegetative treatment shall be established as specified or as shown on the plans. Vegetation shall be applied as critical area planting and will include seedbed preparation, seeding, liming, fertilizing, and mulching. The interior slope of the lagoon shall be either vegetated the same as other areas or mulched at a rate of 2.5 tons/acre to prevent erosion prior to filling of the lagoon.

### **Fencing**

The lagoon shall be fenced when all construction work is completed. Permanent fencing shall be installed as specified in the plan, with safety as the objective. A "WARNING" sign (90 in<sup>2</sup> minimum) shall be placed on each straight section of fencing, not to exceed a spacing of 300 feet, to alert the public to the hazards of the lagoon.